TRANSMITTAL OF DOCUMENTS FOR ACCEPTANCE BY EPA		DATE: 4 **March 2019**	TRANSMITTAL NO.: **005**
TO: **Ms. Katrina Higgins-Coltrain** **U.S. Environmental Protection Agency Region 6**		FROM: **Patrick Appel** **EA Engineering, Science, and Technology, Inc., PBC**	
SUBTASK NO.	DELIVERABLE	NO. OF COPIES	
1.2.3	Treatability Study Work Plan Revision 0.1 Wilcox Oil Company Superfund Site Remedial Design Bristow, Creek County, Oklahoma	EPA: 1 Electronic Copy via email ODEQ: 1 Electronic Copy via email	
ACCEPTANCE ACTION			
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9956463

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4 March 2019

Ms. Katrina Higgins-Coltrain
Task Order Monitor
U.S. Environmental Protection Agency (EPA) Region 6
1445 Ross Avenue
Dallas, TX 75202-2733

RE: Treatability Study Work Plan, Revision 0.1
Wilcox Oil Company Superfund Site
Remedial Design
Remedial Action Contract 2
Contract: EP-W-06-004
Task Order: 68HE0618F0311

Dear Ms. Higgins-Coltrain:

EA Engineering, Science, and Technology, Inc., PBC (EA) is transmitting one electronic copy via email of the Treatability Study Work Plan, Revision 0.1 for the above-referenced Task Order. Revision 0.1 incorporates comments received from EPA on 4 December 2018 and 19 February 2019. EA will also provide an email copy to the Oklahoma Department of Environmental Quality (ODEQ).

Please do not hesitate to contact me at (972) 459-5038 if you have any questions.

Sincerely,

Patrick Appel
Project Manager

cc: Brian Delaney, EPA Contract Officer (letter only)
Todd Downham, ODEQ (electronic copy via email)
Tim Startz, EA Program Manager (letter only)
File

Treatability Study Work Plan
Wilcox Oil Company Superfund Site
Bristow, Creek County, Oklahoma
EPA Identification No. OK0001010917

Remedial Action Contract 2 Full Service
Contract: EP-W-06-004
Task Order: 68HE0618F0311

Prepared for
U.S. Environmental Protection Agency
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March 2019
Revision: 0.1
EA Project No. 14342.169

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LIST OF ACRONYMS AND ABBREVIATIONS

ASTM	American Society for Testing and Materials
CFR	Code of Federal Regulations
COC	Contaminant of concern
EA	EA Engineering, Science, and Technology, Inc., PBC
EPA	U.S. Environmental Protection Agency
FS	Feasibility Study
ft.	Feet (foot)
kg	Kilogram(s)
LAA	Lead Additive Area
LMS	
mg	Milligram(s)
mg/L	Milligram(s) per liter
QA	Quality assurance
QC	Quality control
RA	Remedial Action
RAO	Remedial action objective
RCRA	Resource Conservation and Recovery Act
RD	Remedial Design
RI	Remedial Investigation
ROD	Record of Decision
S/S	Solidification and stabilization
SIM	Selected ion monitoring
site	Wilcox Oil Company site
SOP	Standard Operating Procedure
TCLP	Toxicity Characteristic Leaching Procedure
TSWP	Treatability Study Work Plan
XRF	x-ray fluorescence

1. INTRODUCTION

EA Engineering, Science, and Technology, Inc., PBC (EA) has been authorized by the U.S. Environmental Protection Agency (EPA), under Remedial Action Contract No. EP-W-06-004, Task Order 68HE0618F0311, to conduct a treatability study for chemical solidification and stabilization (S/S) of contaminated source material at the Wilcox Oil Company site (site), Bristow, Creek County, Oklahoma. EA has prepared this Treatability Study Work Plan (TSWP) in accordance with (1) the specifications provided in the EPA Statement of Work, dated 02 August 2018 (EPA 2018a), (2) the EPA Source Control Record of Decision (ROD), dated 05 September 2018 (EPA 2018b), (3) the EPA-approved Work Plan and Cost Estimate, dated 07 September 2018 (EA 2018), and comments received from EPA on the initial submittal. This TSWP describes the objectives, procedures, performance criteria and other details needed to conduct a bench-scale treatability study and field pilot test for S/S.

1.1 PROJECT DESCRIPTION

The site is an abandoned and demolished oil refinery and associated tank farm and is located north of Bristow, Creek County, Oklahoma. The geographic coordinates of the site are approximately 35°50'31" North latitude and 96°23'02" West longitude. The site includes remnants of former oil refining operations and tank farms. The facility has been divided into five major former operational areas: the Wilcox and Lorraine Process Areas, the East and North Tank Farms, and the Loading Dock Area. This TSWP focuses on the Lead Additive Area (LAA) within the Wilcox Process Area (Figure 1).

The LAA has been tested using a field-portable sampling device, called an x-ray fluorescence (XRF) analyzer. Based on field XRF analysis, the sand and white salt-like substance tested very high for lead content. XRF detector readings were above the calibration range, indicating percent levels of lead are present (LMS 2016). Lead results for samples collected during other site investigations range as high as 43,200 to 105,000 milligrams per kilogram (mg/kg) and up to 998 milligrams per liter (mg/L) lead analyzed via toxicity characteristic leaching procedure (TCLP). In general, lead appears to attenuate quickly with depth, falling to less than 100 mg/kg at about 1-foot (ft.) depth (LMS 2016).

Based on the elevated levels found in the LAA and associated refinery tank waste found throughout the site, the EPA issued a Source Control ROD (EPA 2018b) that presents the selected remedial action (RA) for addressing source materials within the LAA. The source control RA is limited in scope to address these areas through excavation, treatment, and offsite disposal. The Source Control ROD has selected the contaminants of concern (COCs) to be benzo(a)pyrene, a polycyclic aromatic hydrocarbon, and lead. The target health-based concentrations for benzo(a)pyrene and lead are 0.011 mg/kg and 800 mg/kg, respectively. Although benzo(a)pyrene is present in the tank waste, TCLP analysis during the ongoing Remedial Investigation (RI) show the levels to be below hazardous waste disposal criteria; therefore, treatment of waste containing benzo(a)pyrene will not be required prior to disposal. This TSWP will focus on treatment of lead-impacted soils within the LAA prior to offsite disposal at a permitted non-hazardous waste landfill.

1.2 PROJECT OBJECTIVES

This TSWP summarizes the proposed sampling and testing approach for the bench-scale and field pilot test treatability studies that will be conducted to support the Remedial Design (RD). The RD includes treatment of the lead contaminated soil/waste in the LAA, and removal and offsite disposal of this material, as well as other areas that contain source material. This treatability study will be conducted to:

- Test lead contaminated soil previously meeting hazardous waste criteria and identify how to treat it such that it can be disposed of as non-hazardous waste that meets permitting and/or regulation requirements. The treatability study will be performed to identify a chemical treatment method for treating the soil within the LAA where lead concentrations in samples exceeded the Resource Conservation and Recovery Act (RCRA)-regulated level of 5 mg/L for toxicity characteristic based on TCLP analyses.

The overall sampling design includes collection of composite soil samples from the three grid areas illustrated on Figure 2. These samples will be submitted to three subcontractors that will use these samples to perform bench-scale pilot testing. Soil samples will then be collected from the soil that undergoes bench-scale pilot testing and will be submitted to a third-party laboratory for verification analyses of the treated bench scale laboratory samples. A third set of soil samples will be collected and undergo verification analyses following the field-scale pilot test.

2. TEST OBJECTIVES

The process outlined in *Guidance on Systematic Planning Using the Data Quality Objectives Process* (EPA 2006) was used as a guide to develop the objectives of the treatability study. The results are presented in the following subsections.

STEP 1. STATE THE PROBLEM

The LAA within the Wilcox Process Area of the site contains elevated lead concentrations in soil that pose an unacceptable risk to human receptors. As part of the source material RA alternative, approximately 2,269 cubic yards of lead-impacted soils in the LAA will be treated, removed, and transported offsite for disposal. The purpose of the treatability study is to perform chemical analyses that will be utilized to determine feasible amendments or amendment combinations, to treat the excavated material to levels which allow it to be disposed of as non-hazardous waste, within permitting or regulatory requirements. The remedial action objectives (RAOs) identified in the Source Control ROD are as follows:

> RAO-1: Prevent ingestion and dermal contact exposure to human and ecological receptors through the removal of tank waste to reach a target health-based concentration of 0.11 mg/kg benzo(a)pyrene and the removal of the LAA to reach a target health-based concentration of 800 mg/kg lead.

RAO-2: Prevent contaminant migration to soil, sediment, and indoor air through the removal of tank waste to reach a target health-based concentration of 0.11 mg/kg benzo(a)pyrene and the removal of the LAA to reach a target health-based concentration of 800 mg/kg lead.

RAO-3: Removal of source materials to eliminate and prevent further degradation of the surrounding environment as a result of exposure to or migration from tank waste and the LAA.

Currently, there is insufficient data to determine whether chemical S/S can treat the lead-contaminated material to meet the non-hazardous disposal criteria. There is also insufficient data to allow for full-scale implementation of chemical S/S, should the technology be selected as part of the site remedy.

STEP 2. IDENTIFY THE DECISION TO BE MADE

The results of the chemical treatability testing will be used to identify a chemical treatment method, including the appropriate amendment and dosage, for treating contaminated materials from the LAA, such that the material does not have a leachable lead content that exceeds the RCRA-regulated level of 5 mg/L based on TCLP analysis.

STEP 3. IDENTIFY INFORMATION INPUTS

Existing site data and data to be collected during this study will be used to determine the amendment or amendment combination and dosage (by dry weight) to achieve chemical S/S of lead in the LAA to render the material RCRA non-hazardous for waste classification (TCLP lead results below the regulated level of 5 mg/L).

STEP 4. DEFINE THE BOUNDARIES OF THE STUDY

The boundary of the study encompasses the sample locations (Figure 2) in the LAA within the Wilcox Process Area of the site. The vertical extent of the study is based on the depth of contamination at the site and the expected depth of removal. The vertical extent of the study extends from the ground surface to a depth of 2 ft. below the ground surface.

STEP 5. DEFINE THE DECISION RULES

A minimum of three formulations of amendments known to reduce lead leachability will be evaluated to determine the amendment and dosage that are capable of reducing lead leachability to levels that do not exceed the RCRA-regulated level of 5 mg/L of lead for toxicity characteristic based on TCLP analyses. If results from TCLP analyses for lead exceed the applicable criteria, additional amendment testing, or alternative amendments may be required (Table 1 located at the end of Section 3). It should be noted that the performance criteria of the amendments are determined by the lead TCLP concentrations; however, additional chemical analyses will be performed. Pre- and post-treatability samples will be analyzed for the other site-related COC (benzo[a]pyrene) to ensure that the treatability option does not adversely impact

that COC. Additional amendment testing, or alternative amendments may be required if the amendment changes the chemistry of the other COC in such a way that it alters the characterization and subsequent disposal classification.

STEP 6. DEFINE THE ACCEPTABLE LIMITS ON DECISION ERRORS

To minimize decision errors, standardized field sampling and analytical methodologies, collection of representative samples, and trained personnel will be utilized for the sampling and analysis. Sample collection will be performed in compliance with established methods and guidelines for acceptability and in accordance with EA Standard Operating Procedures (SOPs). Laboratory data will be reviewed for compliance with established methods and guidelines for acceptability. Laboratory methods will be selected so that analytical quantitation limits meet as many screening criteria as possible. Data determined to be usable for the project will be used to make the decisions identified in Step 5. In addition to ensuring the accuracy and precision of the data, these procedures are designed to minimize bias in the sample results. Therefore, false positives and false negatives when comparing the measured concentrations to the soil quality targets are expected to be rare.

STEP 7. OPTIMIZE SAMPLING DESIGN

Sampling locations are shown on Figure 2. The sampling locations were selected based on historical data collected during the RI and additional EPA-led investigations. The selected locations are representative of the areas where soil removal will occur as part of the RA.

3. TEST IMPLEMENTATION

The test implementation effort to support the treatability testing will involve the following:

- Collection of soil samples from locations within the LAA (Figure 2) for submittal to treatability laboratories, analytical laboratory, and geotechnical laboratory
- Field pilot test implementation
- Post treatment sample analysis.

Field activities will be performed in accordance with the applicable EA SOPs included in the RI and Feasibility Study (FS) Sampling and Analysis Plan (EA 2016a). The applicable SOPs include the following:

001 – Sample Labels
002 – Chain-of-Custody Form
003 – Subsurface/Utility Clearance
004 – Sample Packing and Shipping
005 – Field Decontamination
025 – Soil Sampling

039 – Sample Preservation and Container Requirements
042 - Disposal of Investigation-Derived Material
052 – Field Logbook.

3.1 COLLECTION OF SOIL SAMPLES

Historical assessments have been reviewed to determine sample locations (Figure 2) in addition to using an XRF detector to screen for potential sample locations within the LAA. The goal is to collect three soil samples from grids: one grid at maximum lead concentration and two grids from various locations to assess variability of lead concentrations. The treatability sample summary is included on Table 1. Two to three pounds of material will be required by each of the amendment vendor's laboratories. The goal of this collection method is to simulate a mixed soil during chemical S/S, but also to gather one sample at a location with the potentially highest concentrations of lead. Additional sample material will be submitted for geotechnical and chemical analyses. The geotechnical results will be used to support the RD by determining an appropriate field mixing method. Collection of soil samples will be implemented with the following approach:

1. Three areas within the LAA will be gridded off in approximately 100 x 100-ft. areas as shown on Figure 2.

2. The selected grids will be based on historical waste sample results and field XRF screening during sample collection.

3. One area will be considered maximum concentrations to be expected and the other two areas will be considered average concentrations to be expected throughout the LAA.

4. A standard five-point composite sample will be collected from each grid.

    a. Within each grid, five samples (one from each corner and one from the center) will be collected down to 2 ft. below ground surface.

    b. Each sample will be composited and placed in the appropriate sample containers (i.e., resealable plastic bags). Two to three pounds of material will be required for each sample.

5. Coordinates for each sample location within each grid will be captured using a Geographic Positioning System (GPS) device.

6. The sampling equipment will be decontaminated between each grid.

7. The samples will be submitted under chain of custody to the following laboratories for treatability analysis:

ATTN: Tim Danzer
Free Flow Technologies
4920 Forest Hill Rd, Suite 200
Loves Park, IL 61111
(815) 636-0166

ATTN: Mr. Chris Scott
J Carpenter (Blastox®)
The TDJ Group, Inc.
Technical Services
18 E Dundee Rd., Building 6, Ste 100
Barrington, IL 60010
(414) 491-9055

ATTN: Premier Magnesia /Enviroblend®/Charis Gehret
Ursus Remediation Testing & Technologies, LLC
1204 Springdale Street
Mount Horeb, WI 53572
(610) 551-9436

8. Additional samples will be collected from each of the three composite samples for the chemical and geotechnical analyses listed in Table 1 and submitted to the laboratories listed below.
9. Samples for geotechnical analysis will be sent to the following laboratory:

Daniel B. Stephens & Associates, Inc.
a Geo-Logic Company
4400 Alameda Blvd. NE, Suite C
Albuquerque, New Mexico 87113
(505) 889-7752

Samples for chemical analysis will be sent to the following laboratory:

TestAmerica Houston
6310 Rothway Street
Houston, TX 77040

The parameters, methods, containers, required volumes, and holding times can be found on Table 2 at the end of Section 3.

3.2 POST-TREATMENT SAMPLE ANALYSIS

The treatability laboratories will perform analysis of lead via TCLP only. Following treatment, the laboratories have agreed to place the remaining treated material in sample containers provided by EA for shipment to EA's private analytical laboratory (listed above) for additional

chemical analysis to verify treatability of the lead, as well as to verify that the amendment does not change the chemistry of the other contaminants in such a way that it alters the characterization and subsequent disposal classification.

3.3 FIELD-SCALE PILOT TEST IMPLEMENTATION

3.3.1 Field-Scale Pilot Testing

Following selection of a stabilizing reagent based on the bench-scale laboratory testing, a field-scale pilot test will be performed using the stabilizing reagent and mix design. The field-scale pilot test will consist of mixing approximately 15 cubic yards of material with the selected vendor amendment at the recommended rate. The mixing method will be based on the results of the bench-scale test and site-specific conditions. The field-scale pilot test mixing method should be a similar approach to full-scale implementation to ensure treatability success.

3.3.2 Field-Scale Pilot Testing Sample Collection

Following implementation of the field-scale pilot testing as noted in Section 3.3.1, up to three (one per pilot test) composite soil samples will be collected from the treated material and submitted for laboratory analysis to verify treatability of lead via TCLP. Due to the other site-related COC (benzo[a]pyrene), additional chemical analysis will be performed on the samples collected to verify the characterization and subsequent disposal classification has not changed. Table 1 presents the expected sample quantities and Table 2 presents the analytical parameters, methods, containers, required volumes, and holding times.

TABLE 1. TREATABILITY SAMPLING SUMMARY

Test Parameter	Method	No. of Samples to be Collected[a]		QA/QC Samples[b]
		Bench-Scale Pilot Testing [c]	Field-Scale Pilot Test [d]	
Metals	SW-846 Methods 6010C and 7471B	6	3	3
VOCs	SW-846 Method 8260C	6	3	3
SVOCs	SW-846 Method 8270D	6	3	3
TPH (GRO, DRO, and ORO)	TX Method 1005	6	3	3
TCLP Metals	SW-846 Methods 1311, 3010, 6010, and 7470	6	3	3
TCLP SVOCs	SW-846 Methods 1311, 3510, and 8270C	6	3	3
TCLP VOCs	SW-846 Methods 1311 and 8260B	6	3	3
Reactivity	SW-846 Chapter 7	6	3	3
Corrosivity	SW-846 Methods 9045 and 1110	6	3	3
Ignitability	SW-846 Method 1030	6	3	3
Moisture Content	ASTM D2216	6	---	---
Atterberg Limits	ASTM D4318	6	---	---
Particle Size Analysis	ASTM D6913/D7928	6	---	---

Test Parameter	Method	No. of Samples to be Collected[a]		QA/QC Samples[b]
		Bench-Scale Pilot Testing [c]	Field-Scale Pilot Test [d]	

NOTES:
(a) Sample locations are presented on Figure 2.
(b) Samples include field duplicates and matrix spike/matrix spike duplicates, where applicable.
(c) Assumes 1 sample to each vendor prior to treatability testing and 1 sample following treatment from each vendor
(d) One sample per pilot test will be collected. Up to three pilot tests may be performed depending upon the efficacy of each test.
ASTM = American Society for Testing and Materials
DRO = Diesel range organics C_{10} - C_{28}
GRO = Gasoline range organics C_6 - C_{10}
ORO = Oil range organics > C28
SIM = Selected ion monitoring
SVOCs = Semivolatile organic compounds
SW-846 = Test Methods for Evaluating Solid Waste: Physical/Chemical Methods
QA/QC = Quality Assurance/Quality Control
TCLP = Toxicity Characteristic Leaching
TPH = Total petroleum hydrocarbons
TX = Texas
USCS = Unified Soil Classification System
VOCs = volatile organic compounds

TABLE 2. PARAMETERS, METHODS, REQUIRED VOLUME, CONTAINERS, PRESERVATIVES, AND HOLDING TIMES

Parameter	Method	Volume and Container [1]	Preservatives	Holding Time [2]
Soil Samples				
Porosity, Density, Moisture	ASTM D2216/ASTM D7263	1-gallon resealable plastic bag	None	Unspecified
Grain Size	ASTM D6913	1-gallon resealable plastic bag	None	Unspecified
Metals (including Hg)	SW-846 Methods 6010C/7471B	One to two 8-ounce glass jars with Teflon™-lined caps	Store at <6°C (4+2°C)	180 days (28 days for Hg)
SVOCs	SW-846 Method 8270D	One 8-ounce amber glass jar with Teflon™-lined cap	Store at <6°C (4+2°C)	14 days
VOCs	SW-846 Method 8260C	Three 5-gram coring tool devices (e.g., EnCore) samplers and one 4-ounce glass jar	Store at <6°C (4+2°C)	48 hours
Reactivity	SW-846 Chapter 7	One 4-ounce glass jar with Teflon™-lined cap	Store at <6°C (4+2°C)	72 hours
Corrosivity (pH soil)	SW-846 Method 9045	One 4-ounce glass jar with Teflon™-lined cap	Store at <6°C (4+2°C)	72 hours
Corrosivity (steel)	SW-846 Method 1110	One 4-ounce glass jar	Store at <6°C (4+2°C)	7 days
		One 250-milliliter HDPE bottle	Store at <6°C (4+2°C)	
Ignitability (solids)	SW-846 Method 1030	One 4-ounce glass jar	Store at <6°C (4+2°C)	14 days
TPH GRO	TX Method 1005	One 4-ounce amber glass jar (filled to capacity)	Store at <6°C (4+2°C)	14 days
TPH DRO and ORO			Store at <6°C (4+2°C)	
TCLP Metals[3]	SW-846 Methods 1311, 3010, 6010, and 7470	100 grams minimum (solid) or 1 liter minimum (liquid) in plastic or glass container	Store at <6°C (4+2°C)	180 days (28 days for Hg)
TCLP SVOCs	SW-846 Methods 1311, 3510, and 8270C	100 grams minimum (solid) or 2 liters minimum (liquid) in glass containers	Store at <6°C (4+2°C)	14 days

Parameter	Method	Volume and Container [1]	Preservatives	Holding Time [2]
Soil Samples				
TCLP VOCs	SW-846 Methods 1311/8260B	50 grams minimum (solid) or 120 milliliters minimum (liquid) in glass containers	Store at <6°C (4+2°C)	14 days

NOTES:

[1] It will be necessary to verify container requirements with the laboratory at the time of scheduling.

[2] Holding time is measured from the time of sample collection to the time of sample extraction and/or analysis.

[3] Arsenic, barium, cadmium, chromium, lead, mercury, silver, and selenium

ASTM = American Society for Testing and Materials

°C = Degrees Celsius

DRO = Diesel range organics C_{10} - C_{28}

GC = Gas chromatography

GRO = Gasoline range organics C_6 - C_{10}

HDPE = High-density polyethylene

Hg = Mercury

ICP = Inductively-coupled plasma

MS = Mass spectrometry

ORO = Oil range organics > C28

SVOCs = Semivolatile organic compounds

SW-846 = Test Methods for Evaluating Solid Waste: Physical/Chemical Methods

TCLP = Toxicity Characteristic Leaching Procedure

TPH = Total petroleum hydrocarbons

VOC = Volatile organic compound

4. TREATABILITY TESTING

The TSWP has been designed to identify chemical treatment methods for soils removed from the LAA at the Wilcox Oil site. The chemical treatability component is designed to evaluate an amendment or amendment combination for treating contaminated soils from the LAA where soils were previously identified as characteristic hazardous material due to elevated concentrations of lead. Contaminated soil must meet treatment standards prior to land disposal if it is hazardous (i.e., contains a listed hazardous waste or is a characteristic hazardous waste). Although, the LAA waste is not a listed hazardous waste, it is a characteristic hazardous waste because it exceeds the leaching criteria of 5 mg/L for lead (40 Code of Federal Regulation [CFR] § 261.24). In order to dispose of the waste in an offsite landfill, it must be treated to meet the disposal treatment standards (40 CFR § 268.49[a]) for lead and any other underlying hazardous constituents (40 CFR § 268.49[d]). Based on data collected, no other underlying hazardous constituents are identified for treatment; therefore, only lead will need to be treated to meet disposal treatment standards.

The regulations provide for alternative land disposal restriction treatment standards (40 CFR § 268.49) that can be used to address soil contamination prior to disposal. For metals (i.e., lead), the treatment must achieve 90 percent reduction in constituent concentrations as measured by leachate data collected from the treated material, or 90 percent reduction in total constituent concentration when a metals removal technology is used. The technology being used to treat the lead contamination is S/S; therefore, the 90 percent reduction in constituent concentrations as measured by leachate data collected from the treated material criterion will be used.

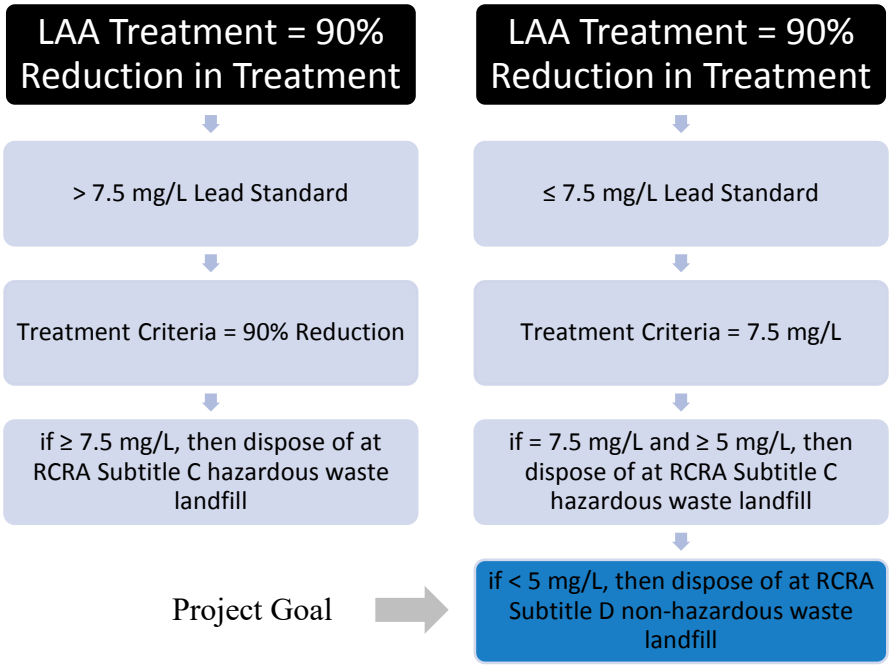
The regulations further state that if treatment results in a 90 percent reduction in constituent concentrations less than 10 times the treatment standard, then treatment need only meet the concentration that is 10 times the treatment standard (40 CFR § 268.49[c][1][C]). For example, the treatment standard for lead is 0.75 mg/L in the leachate. The concentration that is 10 times this treatment standard is 7.5 mg/L lead in the leachate. If following treatment, the concentration is reduced by 90 percent and remains *above* 7.5 mg/L, then treatment met a 90 percent reduction in concentration and the material can be disposed. If after treatment, the concentration is reduced by 90 percent and is *below* 7.5 mg/L, then treatment exceeds the standard and only needs to meet 7.5 mg/L.

As noted in the previous paragraph, if the leachate exceeds 5 mg/L lead, then the material is considered a characteristic waste. Because 7.5 mg/L treatment standard is above the characteristic criterion of 5 mg/L, the soil will need to be disposed at a RCRA Subtitle C hazardous waste landfill, even though it has been treated. Treating the waste to 5 mg/L or less will meet land disposal restriction requirements and allow for disposal at a RCRA Subtitle D nonhazardous landfill (see disposal criteria flow chart at the end of this section).

Chemical S/S amendment testing will be completed to determine the optimal amendment, and amendment concentration by dry weight, for chemical S/S of lead. EA will utilize three subcontractors to perform the chemical S/S testing which will include the following metal-stabilizing products, which have a successful track record of stabilizing lead concentrations similar to those documented for the LAA:

- Free Flow®
- Blastox®
- Enviroblend®.

Disposal Criteria Flow Chart



5. DATA ANALYSIS

5.1 DATA VALIDATION

Data validation is defined as the evaluation of the technical usability of the data. Data verification is defined as the determination of adherence to SOPs, this TSWP, and the laboratory Quality Assurance Manuals. Data reduction addresses data transformation operations such as converting raw data into reportable quantities and units, use of significant figures, recording of extreme values, blank corrections, etc. Data verification ensures the accuracy of data transcription and calculations, if necessary, by checking a set of computer calculations manually. Data reduction will be minimized by utilizing electronic data deliverables from the laboratories. All data qualifiers will be noted in the analytical data summary tables and in the project database. The chemical data will not be validated for this project but will be reviewed and checked for completeness, accuracy, precision, and relevance. Data usability will be accomplished by comparing the contents of the analytical data packages and quality assurance and quality control (QA/QC) results to the requirements contained in this TSWP, the respective methods, and the laboratory SOPs included in the RI/FS Sampling and Analysis Plan (EA 2016a). Geotechnical results and field data will also be reviewed for completeness and usability.

5.2 DETECTION LIMITS AND QUANTITATION LEVELS

The detection limit is a statistical concept that corresponds to the minimum concentration of an analyte above which the net analyte signal can be distinguished with a specified probability from the signal because of the noise inherent in the analytical system. The method detection limit was developed by EPA, and is defined as "the minimum concentration of a substance that can be measured and reported with 99 percent confidence that the analyte concentration is greater than zero" (40 CFR §136). All analytical parameters will be quantified to the method detection limit. Detected values greater than or equal to the method detection limit, but less than the laboratory reporting limit, will be qualified as estimated (J-qualified). Results for all analytical parameters identified as non-detects will be U-qualified. Sample qualifiers will be identified on all tables in the Technical Memorandum and RD report.

5.3 DATA ANALYSIS

Chemical treatability testing will confirm that after each chemical amendment is added, concentrations do not exceed TCLP maximum concentrations for lead. Concentrations of lead in the TCLP leachate will be compared to maximum concentrations of contaminants for toxicity characteristics (40 CFR § 261.24). TCLP analysis, which is routinely required for contaminated soil material placement at landfills and upland locations, are used to identify the potential for toxicity, and to determine if the contaminated soil material would be classified as a hazardous waste. The maximum concentration stated in 40 CFR § 261.24 for lead is 5.0 mg/L. The testing will also confirm that the other COC (benzo[a]pyrene) remains unaffected.

6. TEST EVALUATION AND REPORTING

The treatability study results will be documented in a Technical Memorandum which will be submitted to EPA for review. The Technical Memorandum will be included as an appendix to the RD Report, and interpretation and application of results as they pertain to the RD will be included in the RD Report text.

7. RESIDUAL WASTE MANAGEMENT

Investigation-derived waste may consist of excess soil cuttings generated during field soil sample collection, decontamination water, personal protective equipment used during sample collection, and approximately 15 cubic yards of treated waste material generated during the field-scale pilot test.

All investigation derived waste will be profiled and disposed of offsite in accordance with all applicable federal, state, and local regulations. Should the field-scale pilot test be successful at reducing leachable lead level to below the hazardous waste disposal criteria of 5 mg/L, then the treated soil will be manifested, transported, and disposed of at American Environmental Landfill located in Sandy Springs, Oklahoma. Trucks used to transport the treated field-scale pilot test soil will have automatic tarpaulins and will be decontaminated prior to leaving the site.

8. HEALTH AND SAFETY PROCEDURES

The existing site-specific Health and Safety Plan (EA 2016b) will be followed during onsite activities which requires Level C Personal Protective Equipment while working in the LAA.

9. SCHEDULE

The collection of soil samples for the treatability study is anticipated to occur the week of 26 November 2018. The results of the treatability study are expected within 2 weeks of receipt of the samples. The initial field pilot test is expected to occur in April 2019. A Technical Memorandum summarizing the treatability study will be submitted 30 days after receiving the results of the field-scale pilot testing. The Technical Memorandum will be included as an appendix to the RD Report.

10. REFERENCES

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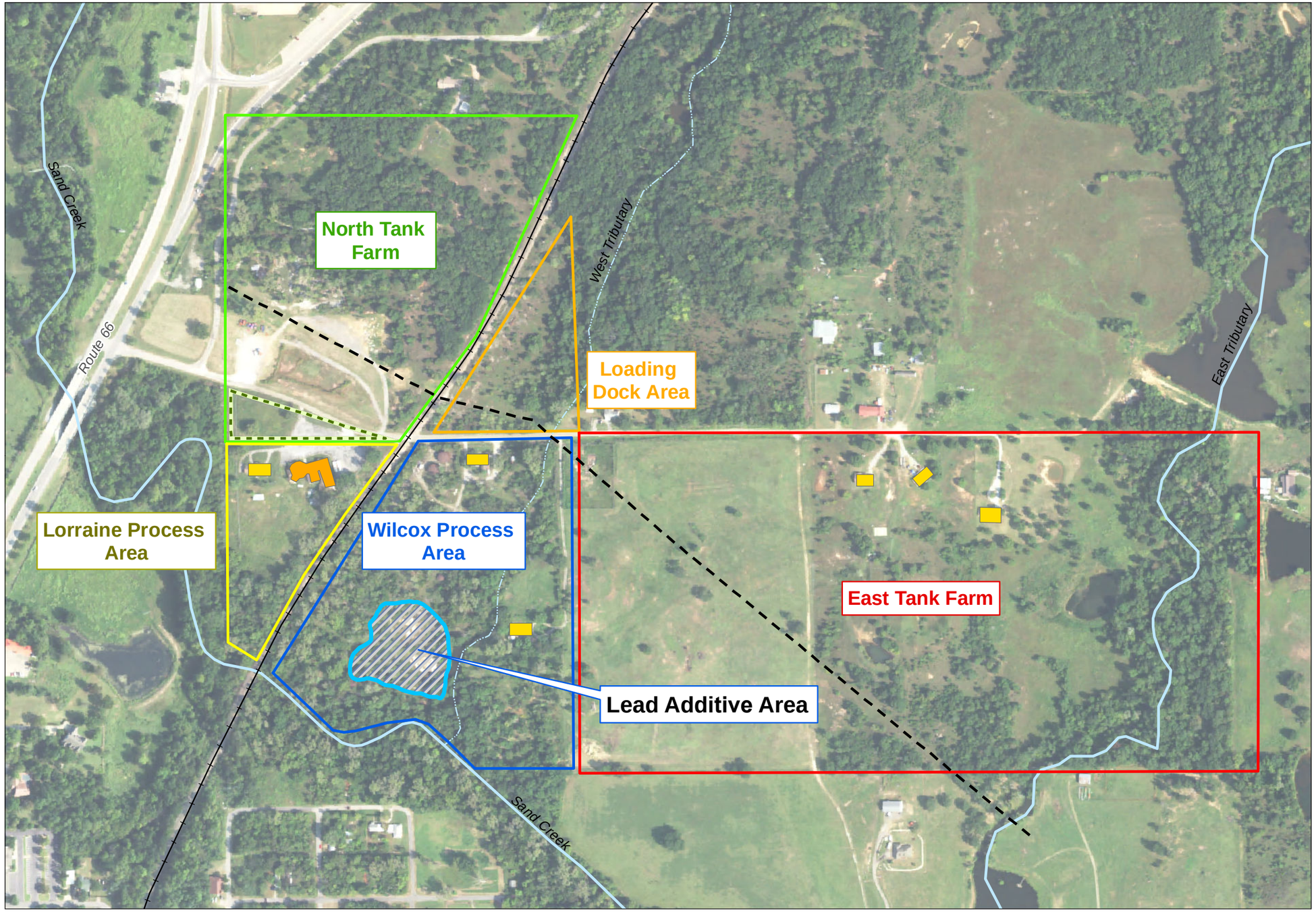
Figures



0 200 400 800 Feet

1 inch = 400 feet

Legend

- Lead Additive Area
- Stream, Intermittent
- Stream, Perennial
- Pipeline
- Railroad

On-Site Building

- Church
- Residence
- Area will be designated as part of Lorraine Process Area for this investigation.

Image Source: National Agriculture Imagery Program 2015.

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Treatability Study
Wilcox Oil Company
Bristow, Creek County, Oklahoma

FIGURE 1
SITE LAYOUT

N

0 25 50
Feet

Legend

- Proposed Composite Soil Sample Locations
- Lead Additive Area
- Waste Sample Collection Location
- Composite Soil Sample Area

Notes:

WPA-WC-05
25 mg/L
Well Identifier Label
Lead TCLP Concentration

mg/L - Milligrams per liter
TCLP - Toxicity characteristic leaching procedure

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Treatability Study Work Plan
Wilcox Oil Company
Bristow, Creek County, Oklahoma

Figure 2
Proposed Soil Sampling Locations